Beans and peas as dough ingredients

PART 2: THE GERMAN COMPANY MÜLLER'S MÜHLE TESTED THE BAKING TECHNOLOGY PROPERTIES OF PULSE FLOURS AND RICE BRAN AND COMPARED THEM TO STANDARD WHEAT

Flours made from broad beans or pearl peas (also known as split peas) have been used as raw materials in bread production since ancient times. These ingredients, when dosed appropriately, provide technological and sensory benefits. Scientific tests, commissioned by Müller's Mühle, Gelsenkirchen, Germany, show the impact of such flours on color, smell, volume, proofing and thawing stability as well as on the freshness properties of baked goods. In particular, flours made from pearl peas yielded positive results. Part 1 of the article dealing with the dough and baking properties with the focus on volume, color and smell, has been published in baking+biscuit international, issue 1/2010.

Impact on freshness properties

The freshness of the baked goods was monitored over a period of seven days; the firmness of the products was assessed with a Texture Analyzer. The result showed that firmness increases with its storage time and also staleness. The force applied in the determination is stated in Newton (N) and reflects the firmness of the products in this test. The results are summarized in figures 6 to 10.

Results – freshness

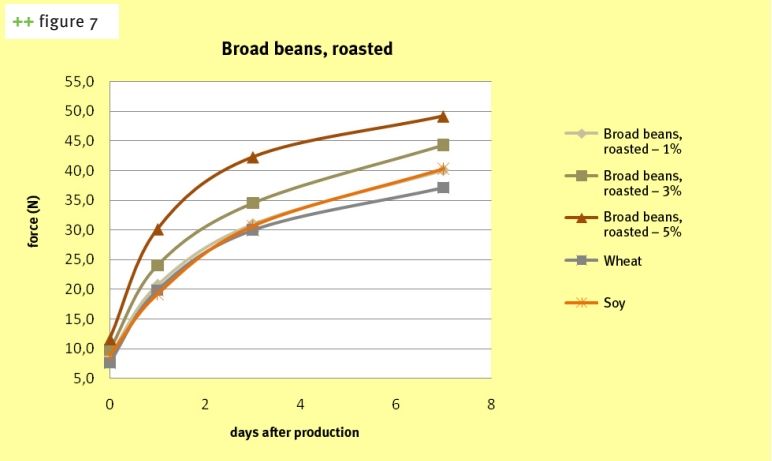
Compared to the standard wheat product, four samples ranked better in terms of freshness. Apart from the 1% addition of unroasted broad beans, unroasted pearl pea flour and roasted pearl pea flour each, the unroasted pearl pea flour added in amounts of 3 baker's percent also yielded a better freshness. The best result is achieved with a 5% addition of rice bran as can be seen from the comparison depicted in figure 11.

Freeze-thaw stability

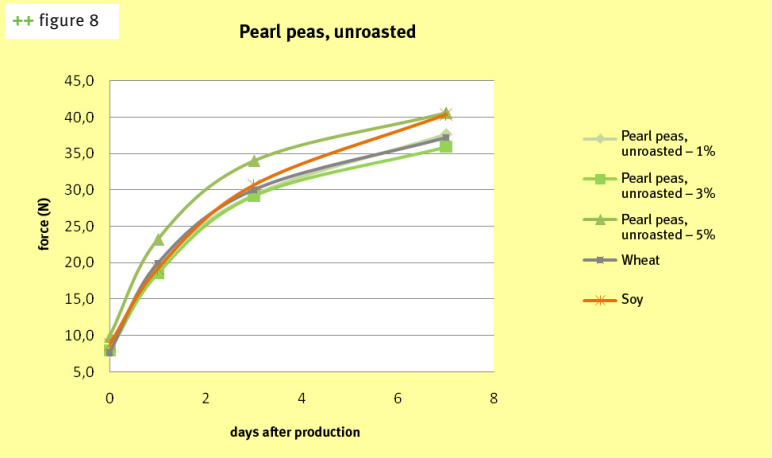
For the freeze-thaw stability test, the dough pieces were subjected to different processing after proofing. Half of the dough pieces were baked immediately after the proofing while the second half were flash frozen at 40 °C. After two days in the freezer at -20 °C, the dough pieces were thawed at room temperature for one hour and then baked. The volume of these products was compared to the volume of the directly baked products. The volume of the non-frozen products was assumed to be 100%. The volume of the

++ figure 6

++ figure 7



++ figure 8

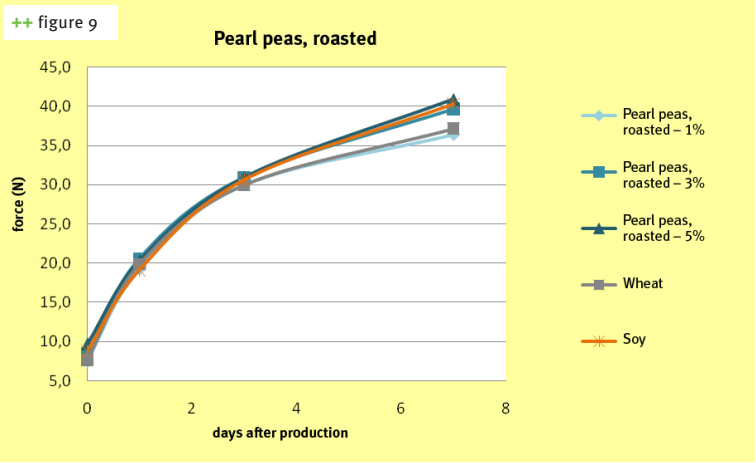


++ figure 6
Freshness of bread made with unroasted broad beans

++ figure 7
Freshness of bread made with roasted broad beans

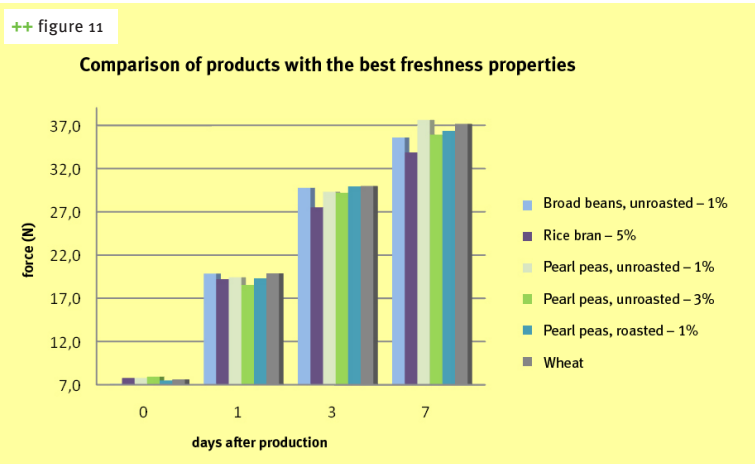
++ figure 8
Freshness of bread made with unroasted pearl peas

++ figure 9



++ figure 10

++ figure 11



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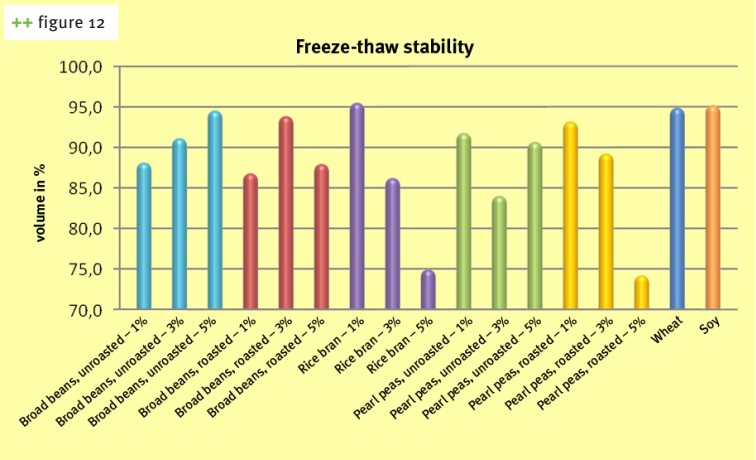


++ figure 9
Freshness of bread made with roasted pearl peas

++ figure 10
Freshness of bread made with rice bran

++ figure 11
Comparison of products with the best freshness properties

++ figure 12
Freeze-thaw stability

frozen products was then compared to the 100% mark thus making a comparison possible. The results are summarized in figure 12.

Results – freeze-thaw stability

The comparison of the respective volumes shows that in most cases the added flours have a detrimental effect on the freeze-thaw stability while wheat flour as standard and also soy meal achieve relatively high values. The freeze-thaw stability cannot be significantly improved with the additives investigated. When adding rice bran or roasted pearl peas, the freeze-thaw stability decreased significantly with increasing dosage (up to 25% loss in volume). The best result was obtained with a 1% addition of rice bran. This value is equal to the freeze-thaw stability of wheat.

Summary

Due to the inactivation of enzymes in the roasted broad bean and pearl pea flours caused by thermal stress, the moisture content of the baked goods is reduced during the production to such an extent resulting in clearly impaired dough consistency and extensibility compared to dough made with untreated pulse flours. This is also true for the technological individual characterization of the roasted broad bean flour (the only roasted product in the comparison) where the increased dry matter content had a detrimental effect on the water binding capacity which in this case was slightly higher compared to the thermally non-treated samples.

In terms of freeze-thaw stability, the product made with 5% rice bran has the lowest stability of all tested samples while displaying the best freshness properties. This can possibly be explained by the high water binding capacity of the rice bran. During the freezing process, the free water in the dough piece forms ice crystals which – other than with the other products – damage the dough structure and reduce the volume of the baked good.

Broad beans, unroasted

Broad beans with a 1% addition yield the best properties (volume, light crumb, improved fresh-

ness). An addition of 3% and more shows increasingly negative properties. The taste turns sour and the freshness is impaired. A possible application of broad beans with 1% addition could be toast bread where the respective product properties are well appreciated. Broad beans with an addition of 3% or more must be included in a product with a sour taste, for example baked goods made with a certain amount of rye (bread and rolls).

In the individual characterization of the samples, the untreated broad bean flour and the pearl pea flour showed the lowest water binding capacity. The fat binding, emulsification and foaming properties are better than the ones found for soy meal so that these products are suitable for replacing soy meal in these respects.

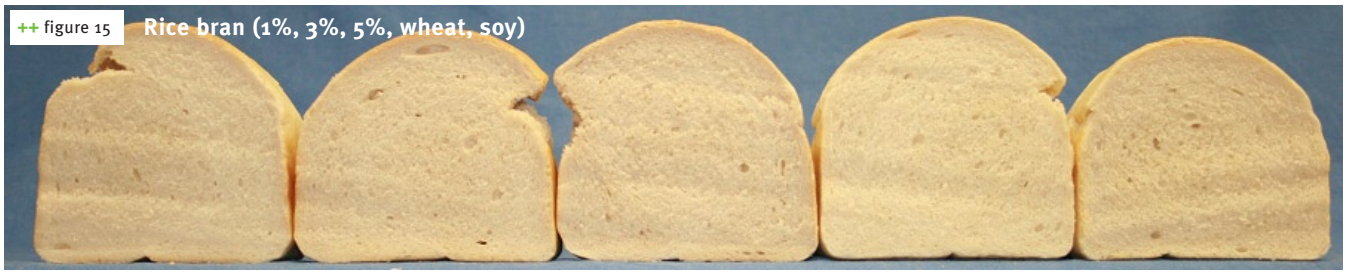
Broad beans, roasted

A 1% addition of roasted broad beans also yielded the best result, but, only in terms of volume. Higher doses reduce the volume below that of wheat flour products and the taste of the baked good also becomes sour. In general, compared to

++ figure 13 Broad beans, unroasted (1%, 3%, 5%, wheat, soy)

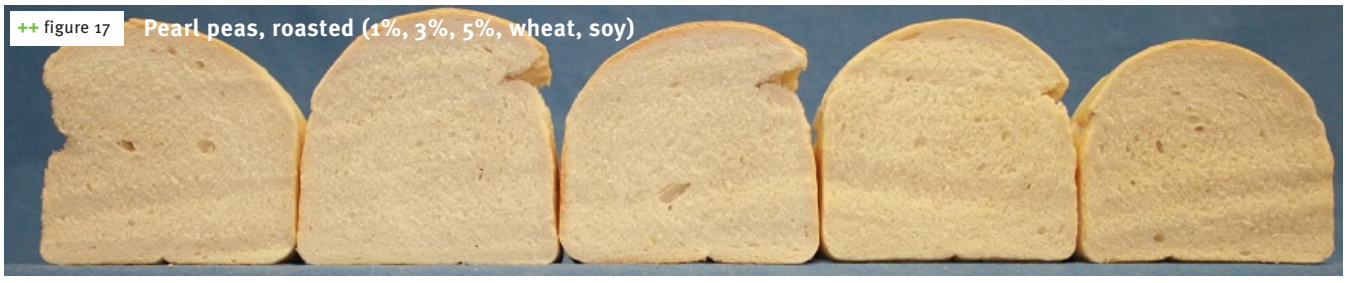
++ figure 14 Broad beans, roasted (1%, 3%, 5%, wheat, soy)

++ figure 15 Rice bran (1%, 3%, 5%, wheat, soy)



++ figure 16 Pearl peas, unroasted (1%, 3%, 5%, wheat, soy)

++ figure 17 Pearl peas, roasted (1%, 3%, 5%, wheat, soy)



standard wheat products, roasted broad bean products yield baked goods with a significantly lower quality (less freshness, impaired dough properties, bad taste and lower volume). The use of roasted broad beans cannot be recommended at this time.
In terms of technological characterization, this product is almost equal to the properties of the unroasted product. It is only the increased dry matter content, which is about 10% above the one of untreated flour that has a better water binding capacity and lower particle size distribution.

Pearl peas, unroasted
All dosages yield a lighter white crumb and all baked goods have a good aromatic smell and taste. Lower additions (1 and 3%) improve the freshness while the volume sinks with increasing amounts but is still above that of wheat. Pearl peas can be used in toast bread (lighter crumb, improved freshness, and flavorful taste) but also in such baked goods known for their pronounced aromatic taste, for example, baguettes, ciabatta, paninis or classical rolls.

In terms of technological characterization, these products displayed the highest results regarding emulsification and foaming properties. The lowest water binding capacity may be due to the lowest content in dry matter. With added water, the untreated flour showed the best results amongst the pulse flours made from broad beans and pearl peas.

Pearl peas, roasted
Roasted pearl peas also yield aromatic final products. Volume and freshness are better than with wheat when added at 1%. The addition of 3% or more decreases volume (below the one of wheat) and freshness. Roasted pearl peas can be used for the same products for which unroasted pearl peas are used, although the reduced freshness and the lower volume have to be taken into consideration.

Rice bran
Dark spots (shell residues) that are visible in the crust and the crumb of the baked goods limit the application of rice bran. Whole grain products or baked goods with high seed content turn this disadvantage into a benefit. The more rice bran used, the higher the volume and the better the freshness. 5% rice bran yields the highest volume with the best freshness. However, the products will develop a rice taste which limits the range of possible applications. Therefore, the final product should have a strong taste so that the rice taste no longer dominates. Possible products would be whole grain toast bread or baked goods with high amounts of seeds. Tests on the technological characterization showed a high fat binding capacity of the rice bran. This would make rice bran suitable for being used in fat-containing baked goods such as puff pastry or Danish pastry. In general, in the comparison, rice bran has the highest water and fat binding capacities while displaying only limited emulsification properties due to the high water binding capacity. Last but not least, the sample had no foaming capacity.

Pictures
Figures 13-17 show the cut baked goods in a direct comparison with each other and with the standards wheat and soy meal.

The basic wheat recipe used for all trials is listed in table 13 at the end. +++

Table 13: Receipe

Recipe	Quantity in g	Parts
Wheat flour	2500.00	100.0
Added liquid	1450.00	58.0
Yeast	75.00	5.0
Salt	50.00	1.5
Additives	25 / 75 / 125	
Processing parameters		
Mixing time	2 minutes at low speed	6 minutes at high speed
Desired dough temperature [°C]	26	
Dough rest 1 after mixing [minutes]	5	
Dough weight [g]	600 g bread, 1500 g rolls	
Dough rest 2 after rounding [minutes]	5	
Final proof [minutes]	45	
Baking parameters		
Baking time [minutes]	28	
Baking temperature [°C]	230	
Amount of steam, stage	320	
Slides open [after minutes]	27.5	